# BIO-DYNAMICS

*A periodical furthering soil conservation and increased fertility in order to improve nutrition and health.*

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## SOIL PROFILES — A Diagnostic Means

EHRENFRIED E. PFEIFFER

Soil profiles can be very helpful in determining the over-all structure of soils as well as in the diagnosis of the causes of various structural difficulties, the recognition of hardpans or other undesirable layers in the subsoil and deeper layers too. This paper does not deal with the rather complicated problems of soil structure, such as the aggregate state, analysis, classification of soils, etc., but is intended to enable the practical grower, farmer, and gardener to get some basic information about his soils in a simple way, in a kind of field, spade-analysis. The method is simple, the tools needed are few, but a great deal can be learned.

### *The Method:*

Dig a hole, one foot square if you do not intend to dig deeper than one foot, larger if you wish to investigate deeper layers. It is important that two sides of the hole have sharply cut sidewalls (faces) and that the soil on these faces is not disturbed or compressed in digging and cleaning the hole. Once the hole is dug, peel a layer off the face without disturbing the structure. The best tool for this purpose is a flat spade, not a curved one; a spade used for ditch digging is ideal. This method will not work if the soil is so wet that water collects in the hole, nor so dry that it resembles rock. Neither of these conditions would permit the digging of a neat clean hole. Therefore, under the right moisture conditions, a neat hole, can be dug.

The second tool to be used, after the hole is dug and a clean-cut sidewall face is visible, is some kind of a scraper. A hand cultivator with three or five solid teeth (*not* spring or wire teeth) such as gardeners use, will do. In an emergency a dull, blunt knife or a small spoon will work. Scrape or scratch carefully along the peeled face of the hole. Make horizontal strokes, beginning at the top; work gently and try to feel the structure of the soil, to determine whether it is crumbly, loose, tight, hard, etc.

Scratch parallel with the surface, slowly "descending" so that you feel your way from layer to layer. Do not make vertical strokes. The idea is to "feel" one layer after the other, to discover in this way the thicknesses of the various layers. Measure the thickness of each layer and plot the findings on a piece of paper.

*Example:*

| | | |
|---|---|---|
| Top inch | : | dry, dusty. |
| 1st to 3rd inch | : | loose, crumbly, friable, breaks easily. |
| 3rd to 5th inch | : | denser, still breaks easily, but not so crumbly. |
| 5th to 7th inch | : | very hard, caked. |
| 7th to 12th inch | : | slightly more crumbly, but not as good as top layer. |

Alongside the structure, note down the changes in color and other physical properties, for instance, sandy, sticky, loamy, sandy-dry, or any other observations you may make. For annual crops it might suffice to go down one foot. For perennial crops, especially trees, the hole should be 2, 3, even 5 feet deep.

For those familiar with the terms A, B and C horizon used in defining soil strata, it may be mentioned here that the layers found with this simplified technique are not always identical with the horizons, although the influence of cultivation (as pointed to in the example given above) would belong to the A horizon. In order to avoid misunderstanding, we shall speak here only of layers or strata in terms of inches or centimeters.

**Discussion of what can be found:**

*Structural Changes.* A healthy soil should have a crumbly structure, break easily when dry, and should not contain large lumps. The deeper this crumbly structure extends, the better the soil.

Heavy clay soil may tend to "silt up" with fine, even colloidal material so that all the pores of the soil are closed. Such a soil gets waterlogged when wet and dries with a hard, caked surface. This crust or cake on the surface level is a severe handicap for successful agriculture. The best remedy is to incorporate more organic matter into the soil and increase soil life since micro-organisms in soil have a very beneficial influence on soil aggregation (the formation of a crumbly structure). Mulching also has a beneficial effect, and such shallow rooting cover crops as will give enough shade to the soil so that a proper tilth can develop. A caked surface layer often results from working a clay soil while it is too wet or from using heavy equipment too much, i.e. packing the soil down. Seeds sown too deep in such a soil may have a difficult time breaking through the hard surface layer, if they can do it at all.

Under the surface layer may be another, a little more packed but still friable. Then there may be a hardpan. This can be caused by plowing a clay soil when it is too wet so that it becomes compact under the plow bottom. Sometimes it is possible to find this glossy, polished plow sole long after it was first formed. If this compacting effect accumulates over many years, a real hardpan of considerable thickness forms. I like to call this the "mechanical hardpan." This cannot be penetrated by feeder, hair roots. The circulation of water and air is interrupted and the soil falls apart into "independent" layers. The surface layer, down to the plowed hardpan, is cut off from resources of moisture and minerals in deeper layers and becomes exhausted. Due to the lack of air in the hardpan and below it, no proper humus formation can take place and a shallow cultivated soil results. Deep rooted plants, like alfalfa, suffer particularly and freeze out easily because their roots scarcely penetrate the hardpan. Also they starve because the mineral and especially the trace mineral resources of the deeper layers are withheld from them. The shallow top layer will dry out readily due to the fact that it has no access to the deeper moist layers. Plants will suffer from even a short drought.

There are only a few sturdy weeds with tap roots which can break through such a hardpan. In fact, if a field has a great many such weeds, one can immediately suspect that it is a case of the survival of the fittest. Unless the farmer knows how to avoid this sort of hardpan, or knows how to cultivate the soil in order to remove it, it would be better to allow these weeds to do the job. Weedicides will certainly not solve the underlying cause.

The best mechanical means of avoiding the hardpan is not to work a clay soil when wet. Mechanical means of repairing the damage are to break the layer by deep cultivation with a spring or spike tooth cultivator or duck foot cultivator. The best tool of all, however, is the subsoiler. Plowing up and turning a hardpan on top, burying a crumbly layer underneath it, creates a soil filled with lumps. Many years ago the writer's attention was called to a field of sugar beets which had a very spotty look, large beets alternating with small ones. The latter were growing on lumps underneath, which had been created by too wet plowing, only the surface had been smoothed out by superficial cultivation.

According to the past history (i.e. cultivation) of a field, there may be one or several hardpan layers of varying thicknesses.

An experienced observer of soil profiles can detect wrong cultivation several years back. Sometimes it can be seen that compost or manure had been buried by plowing too deep and wet, sealing it up between two layers of hardpan, indeed separating it from the top aerated layer, making the latter effective for shallow roots only. Such organic matter might lead to the formation of humic acids which in turn filter down with rain or irrigation into deeper layers. This either means complete loss or can give rise to such severe soil diseases as the formation of iron-alum-humic acid concretions which are very damaging to roots. A farmer will say that he applied a certain amount of manure or compost per acre on the surface of the field but the organic method did not work. It is well to remember that no organic fertilizer should be buried in or below a hardpan, unless the hardpan is broken by proper cultivation. The soil profile will show you where you stand and how to proceed.

It is obvious that the subsoil, which is of an entirely different structure and color, should not be worked into the top soil, or only to a small extent, namely as much as the top soil can take and "digest". Otherwise another type of lumpy pattern will be created, which is very damaging to the development of fine feeder hair roots, especially of plants which are not accustomed to growing into the subsoil.

The deeper layers below the actual cultivated level are of great interest as regards drainage, water supply or losses, standing water, and need study especially where shrubs and trees are to be planted.

Here are the two extremes. After a wet winter with not too much frost, a soil profile was dug in a pasture. The surface layer (18 inches) was squashy wet. The deeper subsoil, sandy loam two feet below, was bone dry. A hardpan between had sealed the subsoil and the whole winter's moisture had run off after the surface was saturated. Erosion under such circumstances is speedy and drought damages show up quickly. The other extreme is one where it is difficult to dig a hole for a soil profile because water oozes in from underneath and the sidewalls cave in. This can happen on badly drained land even though the surface may look dry. It is very important to find out where the water horizon is at the end of rains or winter as well as at the end of a drought.

Knowledge of the water horizons is important especially if one is planting trees, the roots of which are sensitive to standing

water (dying off or danger of fungus diseases). Only shallow rooters are possible for a situation with a high water level, where we might use those with low pyramid forms. The step to be taken when the deeper layers are permanently bone dry is to mulch the surface to train the feeder roots to grow near the surface, accessible to light rains or irrigation, that is to utilize the surface moisture.

*Chemical Changes.* Chemical changes are first seen in the color of the soil. Then samples of the different layers can be submitted for laboratory tests. The results of these tests are sometimes surprising and enlightening. There is, of course, the change from a black-brown humus soil to underlying yellow or red clay, white sand, yellow sand or blue or grey clay, which is about as far down as agriculture goes. These changes are obvious. There are others, mostly of greyish shades which are not so easily observed. The color chart is manifold and sometimes deceiving. A black soil is not always a fertile humus. There is, for instance, the case of the blackish, wet clay, or clay-loam. Here is acidity, lack of air (oxygen) which, together with the reduction of organic matter, causes an increase of carbon and a loss of nitrogen, and a black "staining" with humic acids or raw humus. These are not the rich, black soils with 3, 4, or 5% organic matter, but frequently contain less than 1½% organic matter. There is also the alkaline adobe soil which is also "stained" black, but the color does not indicate a rich humus. Then there are the high organic matter soils tending to become peat. These abnormal cases can usually be easily recognized by their reaction (pH), rather acid or alkaline, and by their lack of a crumbly, friable structure. When wet they are either spongy, sticky, or slimy; when dry, they cake, crust, crack in large crevices, or are dusty.

It is of great help to determine the soil reaction (pH) in connection with the layers of the soil profile. The gardener, for instance, who had a lot of two-legged, split carrots and beets, found the subsoil to be very acid although the surface was all right.

Now for some of the surprises. There was a surface soil moderately low in nitrogen with its subsoil high in nitrogen. Here the farmer had applied a nitrogen fertilizer to a rather loose, light soil with little clay and humus in the top soil. There was no binding power and the rain (or irrigation) had washed the nitrate downward into the substrata and deposited it there

out of reach of the roots of the annual plants on the field. It is true that such things may not happen too frequently with nitrogen, but they do happen to a rather large extent with phosphates, potash, and especially with calcium (lime). These, deriving naturally from the surface soils or fertilizers (or both), can be found away down in many "chemical" layers of the soil. According to the permeability of the soil and whether the surface has enough "binding" or "holding" capacity, due to inorganic and organic colloids with a high absorption power or none, one can find much of the fertilizer of many seasons down below, inaccessible to all roots except the tap roots of weeds, trees or alfalfa. Especially do soils, one-sidedly cultivated with crop rotations of grains and no legume or grass cover rest periods between, show such phenomena. In Dutch polders, the depth of the layer of calcium carbonate deposits below the surface, indicated quantitatively the "age" of the polder, namely, how long it had been under cultivation. This can be expressed in so many inches per decade. Phosphate fertilizer can be found far down. In general, one can speak of a *vertical chemical erosion*. It is well to investigate the deeper layers of the soil and bring about a correction so that the washing downward is counteracted. Some of these layers become very hard, cemented, and one can speak of a "biological" hardpan. A good humus structure on top is one of the best remedies. In forest and prairie soils the washing downward of raw humus leads to podzol formation. All weathered products gradually collect in deeper layers so the surface is free of them.* This, however, means depletion of the agricultural usable surface. The natural weathering process works in this way and the farmer helps it too.

A problem frequently encountered is the formation of iron-alumina humic acid concretions with the subsequent formation of "ortstein", or bog-iron, iron crusts. Yellow and reddish iron oxide containing pebbles, spots and discoloration are found on or near the borderline of top and subsoil, a little of it brought upward by cultivation, and extending downward into the substrata (B horizon).

In southern laterite soils this may even lead to the formation of real iron ore. In the soils of northern latitudes it is frequently found underneath badly drained old pastures (bottom land). These are serious disturbances in the chemical soil pro-

*An excellent book on the problems of soil horizons and podzols is SOILS: THEIR GENESIS AND CLASSIFICATION, by C. F. Marbut, published by the Soil Science Society of America, 1951.

file. Where raw acid humus prevails it supports this development, while a mild neutral humus does not produce "ortstein" or "orterde". The proper humus management of the top soil therefore has an important bearing as a preventative and curative element.

Two anecdotes may conclude this article on soil profiles. One concerns the case of an orchardist in Southern France who called the writer in for a consultation. A fruit orchard had been planted, but when the trees should have borne fruit, they dropped their blossoms and a fungus infection began. From the pattern of the leaf discoloration and the dying of the tips of the branches, it was evident that root damage existed. Upon questioning, the orchardist explained that he had cultivated the soil very deeply before planting the trees and had fertilized heavily with sheep manure. The manure was actually three to four feet deep down, plowed in "so that the tree roots would get something later on". We dug a soil profile four feet deep and there was the sheep manure clearly visible, enbalmed after five to six years. Wherever a tree root had hit it, the disease symptoms showed up. This manure, by the way, was not B. D. composted.

The other story concerns the farmer whose land had been overused, overcultivated and overfertilized for decades. It was run down and he decided to plant trees, to reforest it. Everything seemed to work out well for twenty-five years. Suddenly the entire forest became fungus infected and after thirty years had died off. A soil profile was dug and showed that the trouble started when the roots hit a layer of chemical erosion, which had been created when the land was under cultivated crops many years ago and had remained as a stratum which was poison to the tree roots.

Note: For those of our readers who understand German, the interesting book, Die Grundlagen der Gare im Praktischen Ackerbau, Band I & II, Landbuch Verlag, G.M.B.H., Hannover, may be recommended. This book contains very important material and illustrations in regard to the spade-diagnosis, as Goerbing calls it, of the soil structure, and teaches one how to avoid pitfalls in cultivation.

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## MILES OF ROOTS

Experienced B.D. farmers and gardeners are well aware, especially if they have made any comparative field tests of their own, that the bio-dynamic method strongly encourages root growth in all plants. But not all of us may be familiar with

the extent of such growth, even under ordinarily favorable conditions. In a paper in THE JOURNAL OF PHYSICAL CHEMISTRY, Vol. 57, No. 1, (January, 1953), George John Bouyoucos refers incidentally to "the astounding rate and extent of root growth that plants make in a single season." He continues:

"Dittmer* has estimated that a single rye plant under favorable conditions develops as a seasonal total, a root surface, including root hairs, of 6875 square feet and a total root length of 387 miles, carrying 6603 miles of root hairs. The average daily increase of root lengths alone was estimated at more than 3 miles."

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* H. J. Dittmer, Am. J. Botany, 24, 417 (1927).

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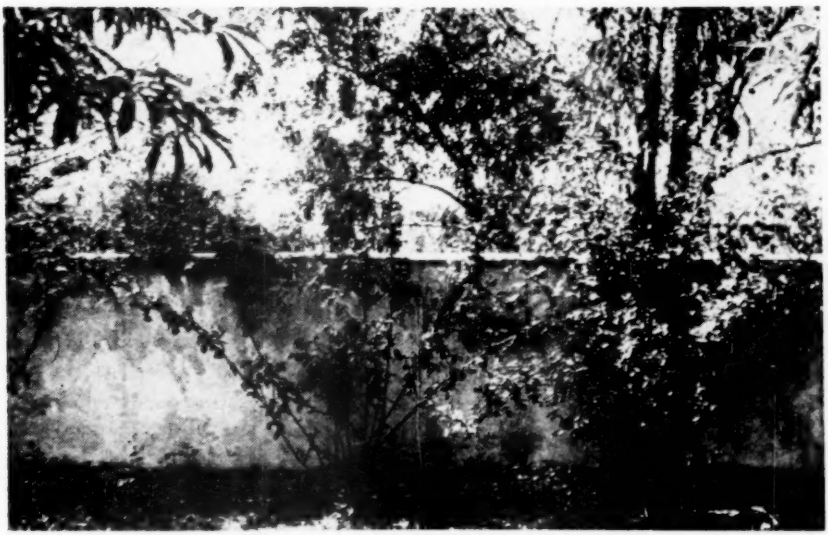
**Three Weeks of Treatment**



Two rose bushes (above) were in equally poor condition. The bush to the right received a shovel full of B. D. Starter treated compost. The bush to the left, nothing. The photograph shows the recovery of the compost treated rose after 3 weeks. The right branch of the untreated rose also got a certain side effect, due to the fact that one root of the left bush extended into the treated area.

## FOREST SEED PRODUCTION IN RELATION TO PLANETARY CYCLES

JOACHIM SCHULTZ

*The author of this paper is a scientist who lives in Switzerland. The material has been gathered together from many sources by him, and confirmed and added to by his own research. It was translated from the German by Helen S. Belsterli, edited by Alice Heckel. The drawings for the illustrations are the work of the artist Richard Kroth. It is too long to be given in full this time, so our readers will have to wait until Autumn for the concluding installment.*

There is great fluctuation among trees as regards their production of fruit and seed. Yet we are accustomed to expect a rather rich harvest every year from our fruit trees, and are disappointed when there is none or only a small one. When we consider the forest trees we find that the case is quite different. The various species blossom, bear fruit and seed as a rule only after intervals of several years. In Northern Europe, for instance, decades may pass before a widespread and full harvest year occurs amongst the conifers.

When forest trees have a good seed year one speaks of "full masts" and in less fruitful years of "half masts" and of "scattered masts", this last meaning that there are only isolated trees with a rich seed supply scattered throughout the stand. Completely barren years are referred to as "mast failures". These old, popular terms call to mind past centuries when it was the custom in Middle Europe to drive large herds of swine into the oak and beech forests for fattening. The size of these herds depended on the beechnut and acorn production of the trees. At that time there also existed a detailed set of laws regulating the use of the land and the forests[1].

The seed years of the forests are naturally of direct interest to us and of great practical importance for the silviculturist since the natural renewal and rejuvenation of our forests is largely dependent on them. Observations made in the vast virgin forests of northern Finland have shown that among the conifers in the mixed tree stands the different age groups are not evenly represented. On the contrary, specific age groups of younger trees are clearly over-represented as distinguished from others. The count of the growth rings confirms these observations. Of

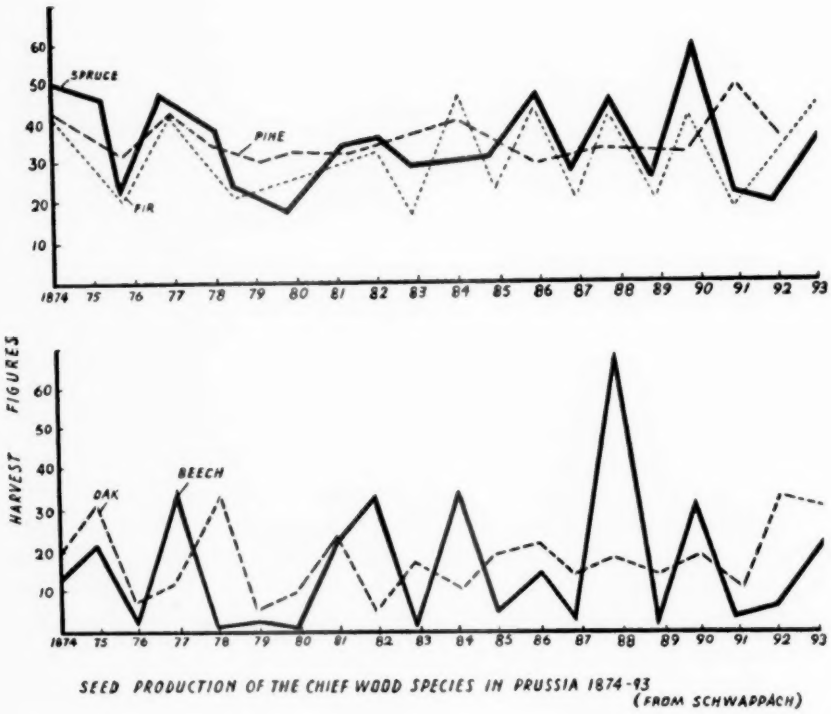
course, belonging to the same age group indicates a common point of origin or, in other words, a seed year which was an exceptionally good one. On this basis, the Finnish forester Lakari[2] was able to determine, to a large degree, the seed years of the conifers in earlier decades and centuries which had been decisive for the second growth and present composition of their forests.

When years of full mast occur the forester can promote the natural seeding and increase of growth by suitable clearing of the forest floor to give the young seedlings air and light for their development. Even when seeding and planting is done artificially the silviculturist has to depend on the seed years. Since they are the great providers of new seed supplies for second growth and reforestation they are of vital importance. Extensive and destructive lumbering began during the war in the European forests and has been continued in the years since. The damaging effects of this upon the whole landscape are much more far-reaching than most people imagine. Consequently, it will become increasingly important in the near future to take note of the seed years and make use of the related possibilities in regard to both quantity and quality in the cultivation of both forest and farmland.

In view of the above, knowledge and recognition of the rhythms in the reappearance of the seed years become of vital importance. The full mast years of the various tree species appear at differing intervals of time and there are also differences of opinion amongst the investigators regarding these intervals. The full mast year of the oak appears on an average about every 5 to 6 years; that of the red beech about every 6 to 8 years. A general and widespread full harvest among all the beeches can only be counted on every 10 to 14 years. Here, too, one can detect discrepancies and variations. Dengler[3] presents the following as a series of general full masts among beeches: 1800 1811 1823 1834 1847 1853 1858 1869 1877 1884 1888 1890 1909 1912 1918 1922.

Then, for the twenty year period from 1874 to 1893, Schwappach[4] has given a more exact and graphic presentation of the seed production of North Germany's forest trees. This facilitates a comparison of the production curves of the different trees such as spruce, pine, oak, and red beech. The further course of the same harvest curves from 1896 to 1910 was then pursued in the same way by E. Seeger[5] for South Germany, so that de-

tailed information which covers a fairly long period of time is available. In summing up the data in his voluminous work on ecology in forestry, Dengler says: "The harvest of the oak is considerably more regular than that of the beech, which fluctuates abruptly. The pine tree occupies a similar position among the conifers in contrast to the spruce and fir, which, as far as seed production is concerned, both show remarkably little fluctuation from year to year. Their likeness in this regard is another expression of their close ecological kinship."




SEED PRODUCTION OF THE CHIEF WOOD SPECIES IN PRUSSIA 1874-93 (FROM SCHWAPPACH)

The variations in the amount of seeds produced by the different forest trees can be easily gathered from a table set up by Schwappach which presents the annual averages of various species in per cent of a full mast or peak harvest year.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. Birch | average | annual | percent | of | a | full | mast 44.8% |
| 2. Hornbeam | " | " | " | " | " | " | 42.0% |
| 3. Alder | " | " | " | " | " | " | 39.9% |
| 4. Pine | " | " | " | " | " | " | 37.6% |
| 5. Spruce | " | " | " | " | " | " | 37.1% |
| 6. Fir | " | " | " | " | " | " | 34.5% |
| 7. Ash | " | " | " | " | " | " | 33.3% |
| 8. Oak | " | " | " | " | " | " | 17.1% |
| 9. Red Beech | " | " | " | " | " | " | 16.2% |

As a rule full harvests occur most frequently among the deciduous trees which produce light weight seeds, and very rarely among the oaks and beeches, the bearers of heavy seeds. The ash and the conifers stand about midway between these two extremes.

So far, relatively little is known about the conditioning factors which influence the appearance of a rich seed year. The most obvious influences of course are the climatic and meteorological ones. Actually innumerable single items of information have been compiled about these factors. For instance, in the western districts of North Germany, where it is warmer and more humid, seed years occur more frequently than in the colder and drier eastern sections. The birch, alder, pine and spruce are far less dependent upon these local climatic differences. Then in regions where late frosts are common, as on the Rauhen Alb in Wuerttemberg, the oak and the red beech often produce no seeds at all. Of course, areas which possess the most favorable life and growth conditions produce good crops most regularly. While one will find as one approaches the cold limit of Northern Europe that all the tree species produce less and less.

When one turns from such special and specific effects of climate and weather to the meteorological influence connected with the *rhythm of the seasons*, it must be clearly understood that a good seed year only occurs when two quite different conditions are fulfilled. *First*, the blossoming and pollination in early spring must proceed undisturbed. Severe night frosts at this time are especially detrimental to oaks and red beeches. Once the blossoming is over, however, later abnormal weather conditions in spring or summer have only a slight effect upon the size of the harvest. However, wet, cold, summers, for example, may produce green, immature acorns, while long droughts may result in crops of dry, sterile beechnuts. The *second* factor has to do with whether there will be a rich blossoming of the forest trees in springtime at all, or not. This presupposes the presence of a great quantity of blossom buds on the trees and their formation and setting can usually be traced

back to the preceding year. Dengler also refers to the dependence of prolific blossom years on the weather, in the following:

"That the unevenly prolific formation of blossoms in certain years must be dependent on the weather is proved by the fact that many forest trees begin to blossom as if by command throughout extensive areas some years, while in other years no blossoming whatever takes place over equally large areas. As the flower buds have already begun to form in the previous summer, the relevant cause can never be found in the weather of the flowering year itself, but it must lie in the preceding year. Statistical research has shown, in fact, that a hot, dry preceding summer seems to favor bud development. This is especially true of trees that bloom at rare intervals, the beech in particular, but it has also been observed in the case of fruit trees."

Recognition of these interrelations may lead to their application in practical affairs. For instance, the question of the probable time for the cherry harvest in an extended region such as Northwest Switzerland and an early forecast of the size of the crop to be expected is of importance to the various firms which provide the necessary labor and transportation facilities. This subject has been thoroughly studied by M. Bider and A. Meyer[6]. They found that the weather conditions of the preceding year, especially changes in temperature, have a decisive influence on the time and size of the coming cherry harvest, provided, of course, catastrophic weather does not intervene at blossom time. The statistical investigations showed definitely that favorable cherry crops were to be expected for Switzerland "when the previous late summer and early fall were dry, warm and sunny, the winter months dry, cold and overcast, and then, above all, April and May dry, warm and sunny".

It has also been established that the meteorological aftereffects of the previous year can be noted in the disposition and development of the *leaf buds* as was the case with the *fruit buds*. Again and again these investigations showed that the weather conditions of the current spring only had a direct influence on the date or time of the sprouting of the vegetative buds. But "all investigators who have taken up this question are agreed that the *total length* of the annual growth is not, or only to a slight degree, dependent on the weather of the current year, whereas it is strongly influenced by that of the preceding one,

because at that time the buds for the next year are already being formed and the necessary reserve food stored in them[1]". Systematic measurements of different tree species usually demonstrate that the annual shoots in the year following hot, dry summer and fall months are very long even though very unfavorable cold weather may prevail during the growing season. On the other hand, cold, wet summers show their after-effect in a noticeable shortening of the next year's shoots.[18]

All of these observations reveal an important relationship. They show that the intensity of the vegetative growth as well as the forming of the blossom buds stand in a close functional relationship to the amount of light and warmth which the trees were able to absorb and store formatively in the preceding growing season. In contrast to the annual plant, which is directly subject to the current annual influences, the tree frees itself from the year's course. It follows larger life rhythms and works with forces which have been given their initial impulse in the preceding year, and in part probably in even more remote periods.

Even though much information has already been compiled on the relationships between meteorological factors and the forming of leaf, blossom and seed of the trees, this alone, however, cannot be considered the last word on the subject. For every tree species has a life dynamics peculiar to itself, which is expressed in the whole rhythm of growth as well as in the fact that individual species produce seeds at longer or shorter intervals of time. Even under similar weather conditions, the seed years of different species in one and the same district do not as a rule coincide. This is clearly evident in the diagram in the case of the oak and the red beech, for example, which sometimes produce their peak crops in one and the same year and then again in quite different years.

There are two promising avenues open for research here which should be studied in detail. The first is the ability of the different tree species to react selectively to one or another weather factor, such as warmth, light absorption, humidity, rainfall, or to a particular combination of several. The second has to do with the existence of the inner life dynamics of the tree which comes to expression in its own specific cyclic rhythms.

In lectures about the inter-relationships of agriculture and forestry Rudolf Steiner called attention to the fact that stellar influence is also reflected in the dynamics of the trees and that

the planetary rhythms are of special significance. From the indications which he has given in this regard the question arises as to whether the cyclic reappearance of rich seed years in the life of the trees may not also be conditioned astronomically. This astronomical question does not in any way contradict the validity of the meteorological influences but is rather a natural continuation and amplification of them. The course of the year itself and the periodicities in the living realms of nature connected with it, point to the cosmically conditioned relationship of earth and sun. In the same way the planetary periods in the cosmos manifest further cyclic rhythms which can be traced in the earth and are reflected not only in long-term meteorological consequences but also in rhythmic biological evolution.

Now the question to be considered is whether the seed years of the forest trees are marked by definite characteristic features as far as their astronomical connections are concerned. From the above described interrelations as well as from meteorological observations it seems obvious that astronomical investigations should be concerned with the years previous to the seed year in question. As will be shown in the following, this is an important key to the problem.

To begin with we will limit ourselves to a consideration of the red beech (Fagus silvatica) since its harvest curve is especially marked and shows strong variations. Then too records of the maximum seed years of this tree have been kept for the last 150 years throughout the whole of Middle Europe where it grows. In the case of other trees the collected facts are less reliable because there are often great time gaps or else they derive from comparatively small areas. It is, of course, obvious that data valid only for a limited locality are not adequate for these studies, material should be drawn from a wide geographic area where the tree in question is at home. According to the authenticated statements of different observers mentioned earlier, 22 main seed years have been established between 1800 and 1922. It was possible to extend and complete this list from 1921 through 1946 thanks to information willingly given by the Waldsamen-Klenganstalt Gebr. Buergi, Zeihen (Schweiz). Many will still remember the universal, heavy beech harvests of 1942 and 1946.

The time period considered in the following gives a survey covering 145 years during which 28 peak seed years of the red beech appear. This next lists the year preceding each seed year,

as these preceding years are essential in considering the astronomical relationships: 1799 1810 1822 1833 1846 1852 1857 1868 1874 1876 1881 1883 1887 1889 1892 1897 1899 1904 1908 1911 1917 1921 1923 1928 1933 1935 1941 1945.

When we now consider the planets Saturn, Jupiter and Venus, one after another, to see whether their positions in the given years are entirely arbitrary or that the periods of *one* or *more* planets fall in the same year, we will find that the latter is the case. This is apparent even though the twelve year Jupiter cycle forms the basic rhythm.

Fig. 1 and 2 of the diagram on the following page show where the planets *Saturn* and *Jupiter* stood in the zodiac in the years preceding the 28 peak seed years. Here it must be remembered that because of their longer time of rotation these two planets alter their positions in the zodiac only slightly in the course of six months or more. Accordingly, each separate dot or spot in the diagrams retains its characteristic position for a whole year. The fundamental calculations had naturally to be carried out within a limited term as a sample or example. The beginning of May has been chosen for this purpose. The sun's position in the constellation Aries is also clearly indicated in the diagrams. In order to have a complete picture of the frequency of distribution of the planetary positions the 28 points under consideration were, for the time being, gathered together according to the 30 degree sections of the ecliptic, the rows of dots forming radii. On the circumference the varying lengths of the constellations are indicated. Thus in the years preceding the 28 seed years, Saturn appears twice in the constellation Pisces, six times in Aries, five times in Gemini, etc. The horizontal middle line connects the starting points of spring and summer in the course of the sun year.

The over-all survey of Saturn's positions in the years in question reveals a rather scattered distribution. In the case of Saturn there is for the time no special one-sided massing of its positions to be expected, for the intervals between the successive full mast years of the beech are throughout smaller than a Saturn circuit. Thus several beech seed years will already have occurred in each of its 30 year rotations. However, there are indications of clustering in the constellations of Aries, Gemini, Leo, Scorpio and Capricorn. These can be explained by the average six-year sub-rhythms, discussed later, which produce a five-fold subdivision in the 30 year Saturn circuit. There

## PLANETARY POSITIONS AND YEARS OF THE RED BEECH
## 1799 • 1945

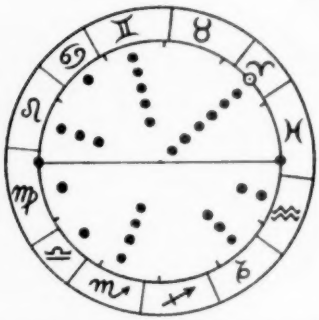


FIG. 1. SATURN (28 PRE-YEARS)

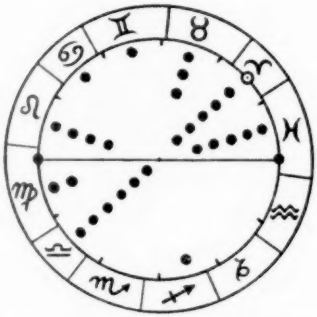


FIG. 2. JUPITER (28 PRE-YEARS)

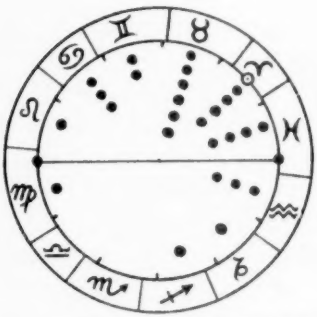


FIG. 3A. MARS { 28 PRE-YEARS / BEGINNING OF MAY }

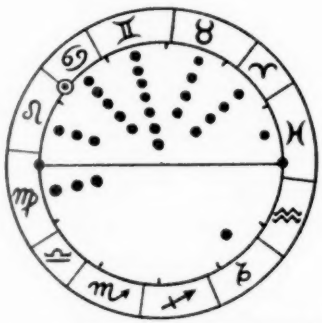


FIG. 3B. MARS { 28 PRE-YEARS / MIDDLE OF JULY }

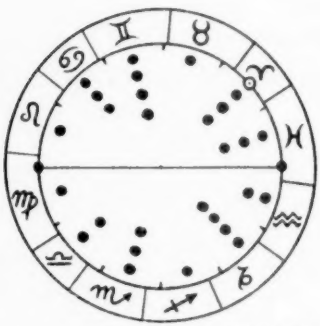


FIG. 4A. MARS { 28 SEED YEARS / BEGINNING OF MAY }

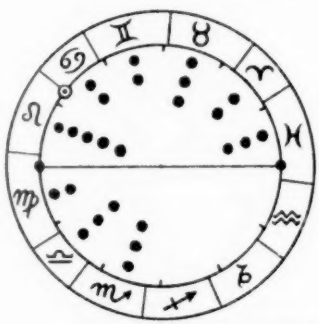


FIG 4B. MARS { 28 SEED YEARS / MIDDLE OF JULY }

is also a distinct preponderance of its positions in the *upper* half of the zodiac. 61% of the seed years fall in the 15 year transit periods of Saturn through the *spring* and *summer* constellations of the zodiac as against 39% which coincide with a Saturn position in the southern half of the ecliptic.

Something quite similar can be observed with respect to the positions of Jupiter (Fig. 2) and in an even more marked degree. In 20 seed years, or 71.5% of the cases, its positions fall in the upper *summer half* and in 28.5% in the lower *winter half* of the zodiac.

Further, two very distinct frequency maxima appear in the Jupiter diagram. An especially marked massing of position dots or points, designated in the following as Series I, is found within the sphere of the constellations of Pisces, Aries and Taurus. A second point of accumulation is almost opposite the first, primarily in the constellations of Leo and Libra. The group of seed years indicated by these positions will later be designated as Series II.

By reason of these two main groupings the whole sequence of all beech seed years falls into characteristic periods and is essentially defined. — Now let us first consider Series I separately. Fourteen of the seed years fall in this series:

| Series I. | 1799 | 1810 | 1822 | 1833 | 1846 | 1857 | 1868 |
|---|---|---|---|---|---|---|---|
| Jupiter's position | Taurus | Aries | Aries | Pisces | Taurus | Aries | Pisces |
| | 1881/1883 | | 1892 | 1904 | 1917 | 1928 | 1941 |
| | Aries/Gemini | | Pisces | Pisces | Aries | Pisces | Taurus |

As one sees, this grouping is repeated at intervals of about 11 to 12 years without interruption throughout the whole period from 1800 to 1945. This series reveals the fundamental periodicity that governs the whole course of the seed years. This basic rhythm runs parallel to the Jupiter circuit throughout. A seed year of Series I will always fall due when in his 12 year circuit Jupiter again reaches the constellations above the vernal point of the ecliptic, i.e. the first quadrant of the zodiac. In the diagram this period can be recognized by the maximum grouping of dots in the constellations of Pisces and Aries.

In this sector of the zodiac Jupiter, at times, stands in a *rising* position similar to that occupied by the sun every year in the spring months of April and May. Here it is quite clear that we have to do with the rhythmic return of the *rising* or *ascendant period* of Jupiter as Rudolf Steiner called it.

The second grouping of seed years, already mentioned, comprises Series II, and these are also related through an average interval of about 12 years.

| Series II. | 1852 | 1874/1876 | 1887/1889 | 1897/1899 |
|---|---|---|---|---|
| Jupiter's position | Libra | Virgo/Libra | Virgo/Sagittarius | Leo/Libra |

| 1908/1911 | 1921/1923 | 1933/1935 | 1945 |
|---|---|---|---|
| Cancer/Libra | Leo/Libra | Leo/Libra | Leo |

In specific instances the years designated in this series sometimes coincide with the periodically recurring transit of Jupiter through the autumnal point in the ecliptic. Here it is very noticeable that Jupiter appears again and again in the constellations of Leo and Libra, while a central position in Virgo seems to be avoided. In contrast to Series I we find in Series II that the seed years do not follow the periodicity of Jupiter with such regularity nor in a sustained manner. In the first half of the 19th Century the relationship is almost absent, or at best merely faintly indicated. On the other hand, we find that often two full mast years follow each other at intervals of only 2 years in this series, something that never occurs in Series I.

As Series I appears to be connected with the *rising* or *ascendant* period of Jupiter, so Series II is connected with the *setting* or *descendant* period. Or to express it differently, at times the one series falls in the *spring* of the 12 year Jupiter period and the other series in the *autumn*.


1. B. Danckelmann: Die Ablosung und Regelung der Waldgerechtigkeiten. Teil 1 und 2. 1888.

2. Acta forestalia fennica. V. 1915.

3. A. Dengler: Waldbau auf oekologischer Grundlage. 1935.

4. A. Schwappach: Die Samenproduktion der wichtigsten Waldholzarten in Preussen. Zeitschr. f. Forst - u. Jagdwesen. 1895.

5. Naturw. Zeitschr. f. Forst - u. Landwirtschaft. 11. 1913.

6. Schweiz. Zeitschrift fuer Obst - und Weinbau, Waedenswil 1946. "Laesst sich der Zeitpunkt der Kirschenernte der Nordwestschweiz vorausbestimmen?"

7. A. Dengler: Waldbau, 1935.

8. H. Burger: Untersuchungen ueber das Hoehenwachstum verschiedener Holzarten. Mitteil. der Schweiz. Zentralanstalt f. d. forstl. Versuchswesen, 14. 1926.

## DIFFERENCES IN ROOT GROWTH DUE TO MINERAL AND ORGANIC FERTILIZATION

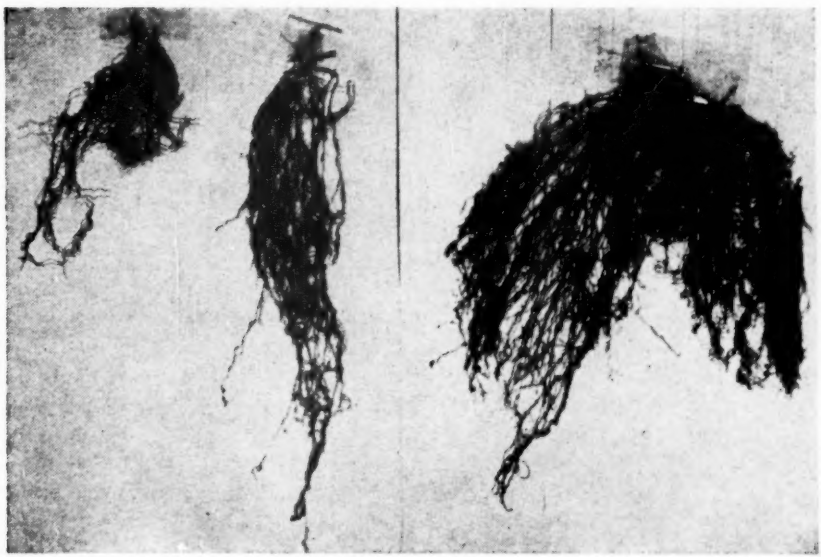
A marked difference in root growth can be observed by using mineral or organic fertilizer.

The following experiment was conducted according to a standard method for hydroponic culture. A mixture of vermiculite and pure sand was used in the containers holding the nutrient solution A.

The same arrangement was used for B, but instead of a standard mineral nutrient solution, a compost produced with B. D. Compost Starter was used. Care was taken to see that the NPK content of both groups, A and B, was alike.

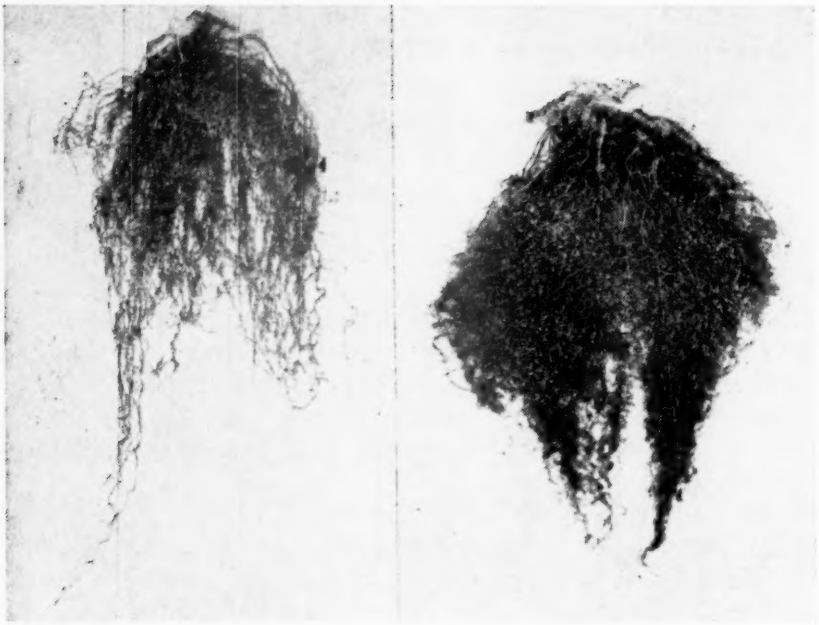
Lettuce, tomatoes and corn were grown for 55 days in both groups. The roots shown here were carefully freed of the adhering sand and washed.

The roots in group A and group B, shown in the photographs, are of exactly the same age (55 days), each representing the average root from a group of 5 plants. They were photographed at the same distance so that the difference in size is the actual difference.



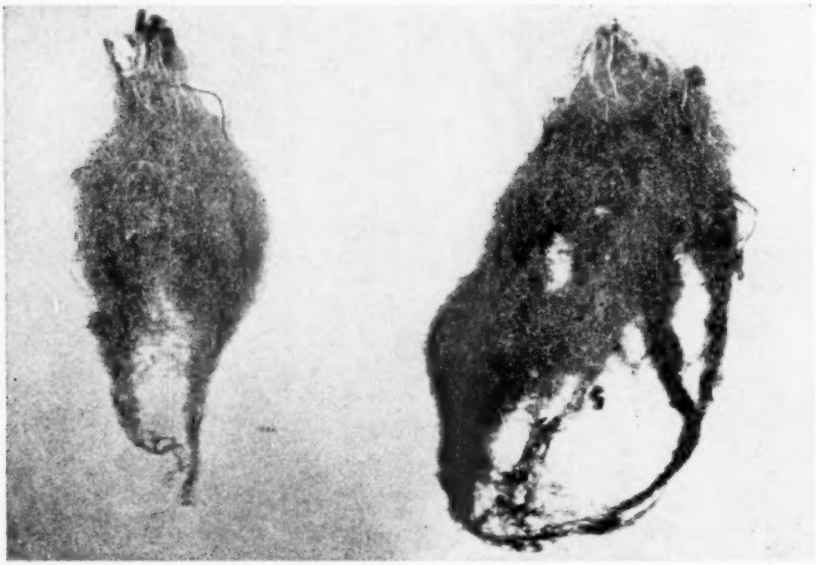
**Roots of Lettuce Plants**

A. Nutrient solution B. B.D. Starter compost



**Roots of Tomato Plants**

A. Nutrient solution B. B.D. Starter compost



**Roots of Corn Plants**

A. Nutrient solution B. B.D. Starter compost

The photographs show the root stimulating effect of the organic treatment resulting from the readily available mineral nutrients due to increased bacterial action.

In the case of the tomato plants, the difference is not only one of size but the entire root pattern is quite different. There is a different pattern of fine (feeder) hair roots as well as of main roots. The tomato is especially sensitive to the organic influence.

(From unpublished experiments of the Biochemical Research Laboratory, Spring Valley, N. Y.)

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## ABSTRACTS AND QUOTATIONS

The B.D. farmer and gardener is always interested in the whys and wherefores that stand behind the biological phenomena of plant life that he is trying to "collaborate with" rather than make a blind use of. So it comes about that scientific material, the data of observation and experiment, may be of great interest even though he personally can do no more with it than file it mentally, under a heading of *Background Information.*

An instance of such an article is the paper that appeared in the *Scientific American* of May, 1952 (Vol. 186, No. 5), by Aubrey W. Naylor, entitled "The Control of Flowering." The author points out that the environmental factors of temperature, light, water and nutrition all play their part in the process and have been used by clever gardeners and greenhousemen to force plants for market deadlines. Yet he adds that their empirical methods "have shed little light, however, on the physiological process that transforms a plant from the vegetative foliage-producing to the flowering state."

He goes on to tell of a bamboo plant from the island of Jamaica which flowers once, after 32 years of growth, and then dies. "Its life cycle," he states, "seems to be independent of the environment; transplanted to any other part of the world, the plant still blossoms on schedule at the age of 32 years, no earlier and no later." After telling of the studies of temperature and of the response of plants to the length of day in relation to flowering, he returns to "the main question: What is the chemical basis of flowering?" Citing work done by scientists in various

parts of the world, the author comments that "All in all the evidence seems overwhelmingly in favor of the idea that a flower-producing hormone does exist." Pointing to the need for more research, he comments, in concluding his paper:

"The results so far in the chemical control of flowering have been highly promising, in some cases even spectacular, and the future is bright. When the flowering process is fully understood, progress will, of course, be much faster. We may even be able to force into bloom plants that now flower rarely."

* * *

The weather, and various theories as to climate, are discussed in another article in the back files of the same magazine, the reading of which in its entirety may also be of interest to gardeners and farmers. This is a paper in the April, 1952 *Scientific American*, by Harry Wexler entitled "Volcanoes and World Climate." The author discusses the different theories put forward to explain climatic shifts: that they may be due to fluctuations in the energy output of the sun; that our weather may be affected by fluctuations in the sun's ultraviolet radiation, these related to sunspot activity; that long range climate changes, including the ice ages, result from trends to wobbling in the spinning of the earth and to periodic shifts in its path around the sun.

The paper, as its title shows, gives its main attention, however, to volcanic explosions in relation to long-term climate variations. Pointing out that dust in the air scatters, reflects and absorbs the sun's radiation, the meteorologist notes that if volcanic ash in the upper atmosphere could keep an appreciable amount of sunlight from reaching the ground it might well cool the area below it. If there were enough volcanic explosions, the dust, which stays in the air for many years, might accumulate to an extent that would "nourish glaciers and bring on an ice age." He remarks that while the whole theory is not new, there are new reasons for reviving and reconsidering it. The Northern Hemisphere, which has had no major volcanic activity since 1912, is experiencing warmer weather in the middle and low latitudes, while in the Southern Hemisphere, where there have been major outbreaks in 1921 and 1932, "there is some evidence that in the last 30 years or so temperatures have decreased and the ice has grown at the higher latitudes."

The paper notes objections to the volcanic theory of climate change, and says in conclusion that "It would be foolish to argue that volcanic explosions are the sole cause of long-range climatic variations, but this is the one theory for which we have been able to find any kind of check by direct observation. Its chief strength is the established fact that a single volcanic explosion can substantially reduce the amount of solar radiation reaching the earth for as long as three years."

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## MORE FOOD FOR THE THOUGHTFUL

Naturally we have an interest in wholesome, tasty and nourishing food. Otherwise why would we work so hard with the soil and the balancing of natural life? Yet we do not concur in the saying, "Man is what he eats". He is far, far more than that, and what he eats is - or should be - controlled and modified according to what he is. Rather we believe, "Man does not live by bread alone." There is a happy medium in the matter of food, between allowing it to be the main factor in life and neglecting it to the point where one does barely go on living. We may as well come to reasonable terms with necessity. We certainly like to preserve the values in the food we raise. Yet it is not always easy, especially for a beginner, to find the best ways of doing this. Hence this modest recipe exchange. Our thanks to those who have cooperated.

Evelyn Speiden

Mrs. Rosella D. Eddy says these three are her favorites:

### WHOLEWHEAT HONEY COOKIES

| | | |
|---|---|---|
| 3 C wholewheat flour<br>¼ t. salt<br>½ t. soda | mix and combine with | 1 C honey<br>½ C peanut oil<br>1 egg |

½ C each of raisins and chopped nuts may be added if desired.

¼ C sour milk added makes softer cookie, similar to old-fashioned drop cake.

Drop by spoonfuls onto greased cookie sheet. Bake 12 minutes at 350 degrees.

## WHOLEWHEAT CAKE OR CUP CAKES

2½ C wholewheat flour
½ t. salt
½ t. soda

mix and combine with

½ C peanut oil
1¼ C honey
2 or 3 eggs
½ C sour milk

Bake in layer cake pans 35 minutes at 350 degrees. Fill and ice with the following mixture. Boil ¼ C honey two minutes at rolling boil. Add to beaten egg white, beating until fluffy. Sprinkle icing with chopped nuts.

For cup cakes add ½ C raisins. Bake only 25 minutes.

## WHOLEWHEAT BREAD

6 C wholewheat flour (or 4½ C wholewheat flour and 1½ C whole rye flour)

2 t. salt
1¾ C milk
¼ C honey
2 T peanut oil

heat together to lukewarm, add 1½ yeast cakes (or packages) dissolved in ¼ C lukewarm water

Mix all together with flour, knead a little, let rise 1½ hours.
Knead, put into pans and let rise 40 minutes. Bake 35 or 40 minutes at 350 degrees.

Mrs. Louis L. Browne sends these:

## WHOLEWHEAT SPONGE CAKE

1 C (scant) finely ground wholewheat flour sifted 3 times

4 eggs, whites and yolks beaten separately

1 C raw or brown sugar, folded into egg whites

2 t. lemon juice, added to egg yolks

Combine two egg mixtures and add flour. Flavor to taste.

Bake 20 to 30 minutes at 300 degrees.

## BOILED FROSTING (for above cake)

1 C sugar, raw or brown
1/3 C water

stirring constantly, bring to 240 degrees or until it spins a thread

½ T lemon juice
1 egg white

Pour hot mixture gradually onto egg white, beating constantly until cool enough to spread on cake. Add the lemon juice and orange rind if desired.

## MARMALADE

First Day — Put through meat chopper the pulp and rind of 1 orange, 1 grapefruit, 1 lemon

Add twice as much water and set aside for 24 hours.

Second Day – Boil 30 minutes.

Third Day– Add equal parts of sugar and boil 60 minutes. Put in jars.

Fourth Day — Cover with paraffin.

## SOME PRACTICAL SUGGESTIONS

STERLING W. EDWARDS

TRY THIS NEXT TIME YOU GRIND FLOUR. Those of you who now have your supply of this season's wheat at home can try this experiment and see if the end result improves the texture of your loaf. As you know, much local wheat is cut today by combine, and goes to the mill or elevator with high water content. Generally speaking, wheat when cut by binder and let stand in shock under sun for some time, cures better and seems to produce a drier berry, making a fluffier flour and producing a light loaf.

In the last 4 bakings, we placed our wheat in shallow pans to dry for many hours in the oven of the wood range, on the day before baking. While we do not fire up this range just for wheat drying, usually having some other use for the stove, we do use it whenever possible as it operates so much more cheaply than the electric range beside it. Those not having such a range can use the electric oven when it is cooling down after baking, or place the pans on radiators for several days, or in direct sun, or in front of the open fireplace. Wheat must not get hot; only slightly warm.

This heating before grinding, results in producing a lighter bread than ever before for us, a loaf that compares in texture even above the chemical loaf on the store counter. We have always worked for a light, fluffy, spongy loaf, as we don't like a soggy, wet, yeasty, heavy mass of cooked dough that looks like a loaf of bread but isn't.

WE TRIED DRYING PEARS IN THE RANGE OVEN. Two halves of a great, luscious, juicy pear shrink down to chicken ears after some hours of gentle heat. The big bowl of pear halves that looked so wonderful become a mummified and shrivelled handful. Yet this method of preparing fall fruit for winter use is a very old custom, and especially valuable when you are tired of canning, or have suddenly used up all your jar supply. Some of the older folks here in the mts. still dry in the sun, and others use little drying racks into which loaded screen frames fit, the whole being placed on the wood stove.

## BOOK REVIEW

*A New Heart At 66.* By Charles W. Eddy. An 8-page pamphlet published and copyright by the author. Available from him at 51 Outlook Avenue, East Providence, R. I., for 25 cents each (postage prepaid), five for one dollar.

These few pages, largely concerned with the home production and consumption of food, are packed with nutrition in more ways than one. Whether one agrees, or not, with all of Charles Eddy's conclusions as to the whys and wherefores, one can hardly fail to come away from his report without getting a stimulus to one's thinking on diet questions, and some immediately applicable suggestions to boot.

Whoever has heard Mr. Eddy tell of his gardening experiences at one or another Bio-Dynamic Summer Conference will recognize him here in this booklet, a good observer and reporter of factual experiences, and always utterly sincere. The first part, reading a little like a Horatio Alger story, tells of his first 58 years and more than suffices, with its tale of a fantastically strenuous schedule of activities, to show why he might well have been in need of "a new heart".

Eight years ago he and his good wife and family acquired a mountain farm. In some ways their life has been, and continues more strenuous than ever, but, as he will tell you if you read these pages, their health has taken a remarkable turn. Disclaiming the discovery of any "elixir of life", the author says that "on the whole we are enjoying better health and greater happiness than at any other time", and "one of us, now 66 years of age, seems to have a new heart".

His experience was that "the most radical improvement in our health" followed their change to the exclusive use of honey for both cooking and table use, bio-dynamic grain products exclusively, and raw instead of pasteurized milk. But there is no austerity in their menus, and this review could almost guarantee that the reading of what you would get to eat if you happened to come up and visit the Eddys will give you a healthy appetite.

The author makes no claim to being a scientist, but he is a good observer and does his best to remain objective in his conclusions. His little book is well worth getting and reading.

F. H.

## WHERE BIO-DYNAMICS GOES

Bio-Dynamics goes out from Chester to thirty-six states and twenty-two foreign countries. Getting it ready to go makes an all day picnic - and then some - for three persons. Alice and Fred Heckel go over to Evelyn Speiden's and addressing, filling and stamping progress at a furious pace, except for lunch time, when we have a rare chance to visit. We have an addresserette, but you'd be surprised how addresses change. Sorting according to states comes at the end. Ever since a batch destined for eight countries went to South America, we send them out over a period of several days, according to locality. And first of all, go the two copies for Library of Congress with application for copyright.

The sorting is the most interesting part of the job, as we watch the various piles grow. The size of the piles for Illinois and Ohio has been the most dramatic increase in recent months, with other midwestern states coming up too. Florida and Rhode Island have risen also to among the highest ten states. New York has always been at the top but California has taken second place in recent years. Since the Bio-Dynamic Method was first known and practiced in New York and New Jersey and early conferences were held in this region (now the West Coast has them too), it was natural that Bio-Dynamics began its career largely within a two hundred mile radius of New York City. To see its circulation spread since Summer 1941 over a good part of the world, has been exciting, especially as the only propaganda has been individual recommendation. It demonstrates that a product which fills a need can really sell itself. The growth has been slow, it is true, but a steady, healthy pace. Now we wish its friends would help again to speed this growth, for production costs are still rising and we hear postal rates will also. To increase the number sold is the best way to offset these costs. As you believe in the ideals for which Bio-Dynamics stands, won't you help increase its circulation? It is an educational venture rather than a commercial one, yet the magazine must pay its own way.

Where is your state on the following list? Perhaps you can bring it nearer the top by loaning your copy of Bio-Dynamics and letting more folks know about it. You'll need no high pressure salesmanship. If friends are interested, they'll take fire at once.

If not, - try someone else. You might get two copies regularly for yourself and keep one moving among your friends. Also back numbers of some previous years are still available at 25 cents a copy, plus 7% postage.

This is where the last issue of Bio-Dynamics went, arranged according to number of copies, States of equal rank are grouped together.

1. New York
2. California
3. *Foreign Countries*
4. Pennsylvania
5. Ohio
6. Illinois
7. New Jersey
8. Connecticut
9. Florida
10. Wisconsin
    Massachusetts
11. Rhode Island
12. Vermont
    Washington, D. C.
    Maryland
13. Oregon
    Missouri
    Virginia
14. New Hampshire
    North Carolina
15. Minnesota
    Kentucky
    Washington
16. Georgia
    Maine
    Nebraska
    Michigan
17. Montana
18. Iowa
19. New Mexico
    Arizona
    Arkansas
    Indiana
    Nevada
    Idaho
    Kansas
    Texas (!)

Foreign countries include Canada, Mexico, Cuba, Bahamas, Central America, South America, South Africa, New Zealand, Australia, Scotland, England, Holland, Belgium, France, Germany, Switzerland, Italy, Norway, Sweden, Denmark and Asia.

E.S.

ADVERTISEMENT

BIO-DYNAMIC Whole Wheat Flour and Cereal, BD Rye Flour and Cereal, BD Cornmeal, BD white pastry flour, stoneground and organic oatmeal. 5 lbs. $1. - plus postage. Lower prices on 25 lbs. and over.

**WALTER BUSCHMAN R. D. 1 Chester, N. Y.**

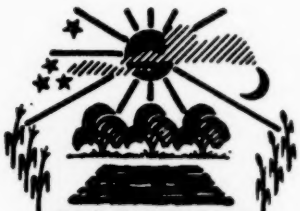
## HELP WANTED

Farmer for general, organic farm near Trenton, N. J. 40 head dairy herd. Must be capable and experienced in milk production, feeding and field work. Profit sharing system. Only a man whose family drinks raw milk will be considered. Four room cottage, all improvements. Write giving age, qualifications, when available and size of family.

**Reply to Box a-1, Bio-Dynamics**
**c/o Speiden R.D. 1, Chester, N. Y.**

### Merryvale Farm For Sale

This organic farm at Guilford, Vermont, 5 miles south of Brattleboro, is on the market only because the owner and wife wish to join their son at school in Colorado. It is in active operation, famous for its chickens, sold deep-frozen with customers as far West as Chicago; and with customers, both local and at a distance, buying its potatoes and other produce, the demand far exceeding the supply. The land, with 25 acres of mowing and cultivation and 15 in pasture and woodland, has been organically treated since June, 1946. For description of the comfortable and ample-sized house, and the farm buildings (as well as any further details), address the owner, Clarence L. Holden, Brattleboro, Vt., R.F.D. No. 3. The price of twenty-five thousand dollars includes the farm and equipment, produce and feed on hand, and the farm name and good will.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